TITLE: Object Location System and Method Using RFID
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DOCKET NO: 022.0047(1726)

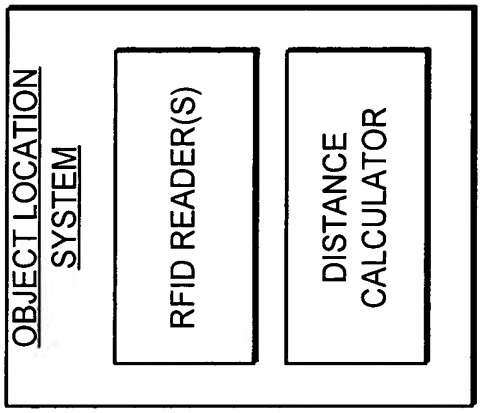
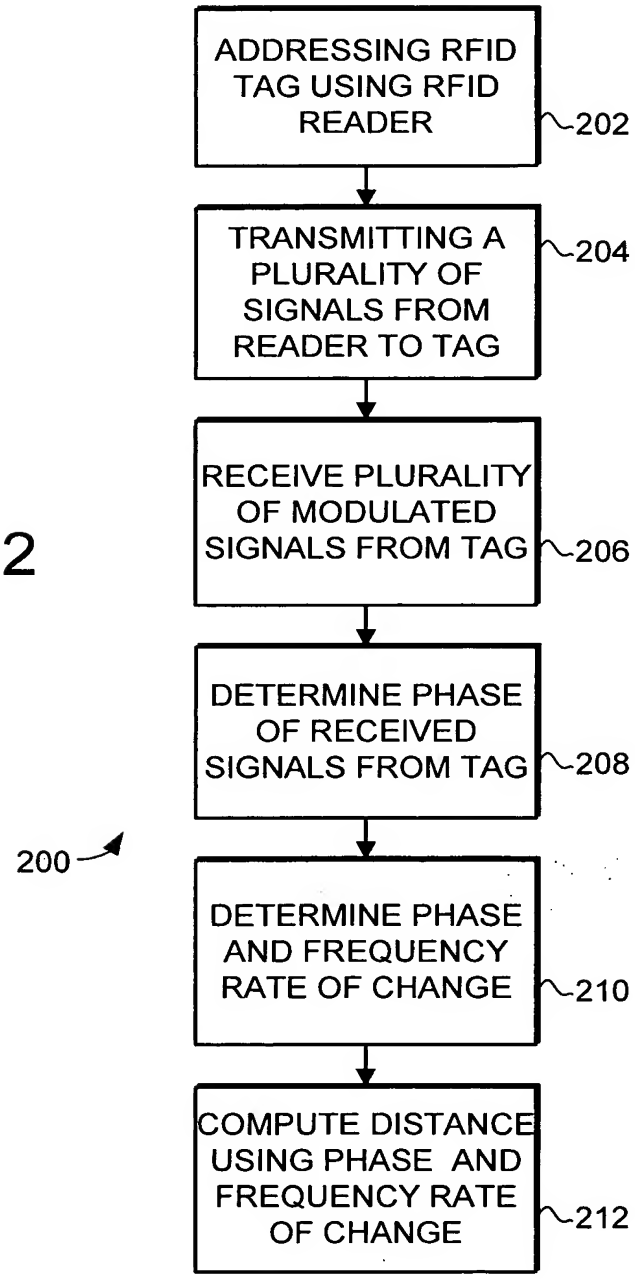


FIG. 1

FIG. 2


ADDRESSING RFID TAG USING RFID READER
202
TRANSMITTING A PLURALITY OF SIGNALS FROM READER TO TAG
204
RECEIVE PLURALITY OF MODULATED SIGNALS FROM TAG
206
DETERMINE PHASE OF RECEIVED SIGNALS FROM TAG
208
200
DETERMINE PHASE AND FREQUENCY RATE OF CHANGE
210
COMPUTE DISTANCE USING PHASE AND FREQUENCY RATE OF CHANGE
212

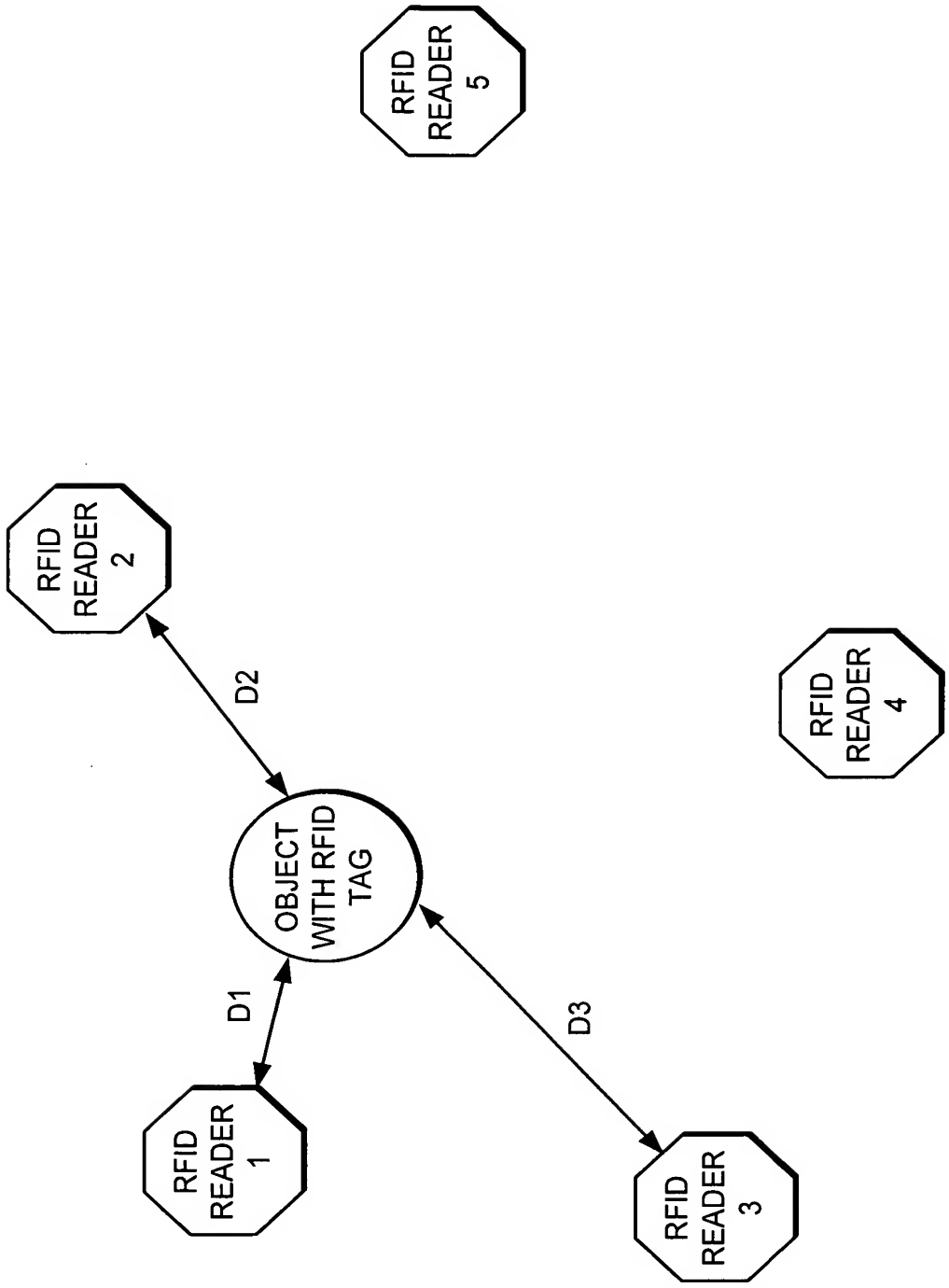
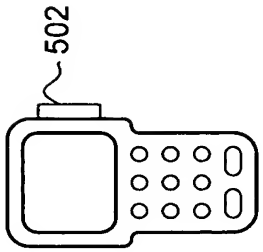
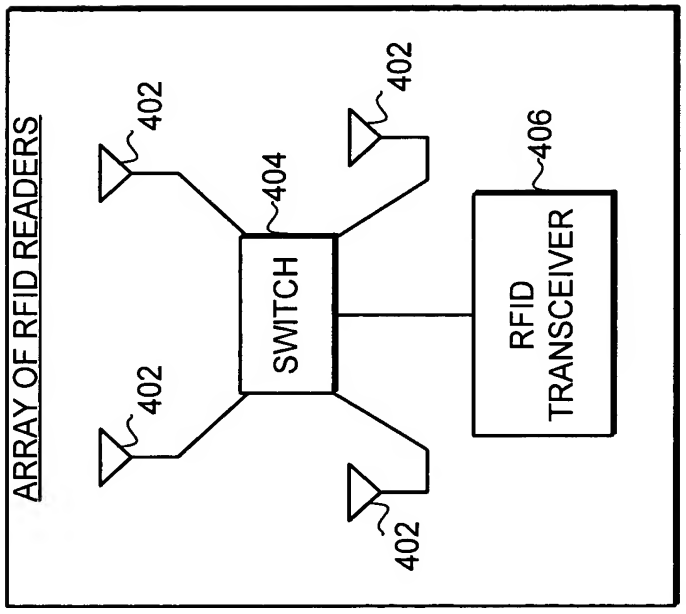

RFID READER 5
RFID READER 2
D2
OBJECT WITH RFID TAG
RFID READER 4
D1
D3
RFID READER 1
RFID READER 3
300

FIG. 3



500

FIG. 5



400

FIG. 4

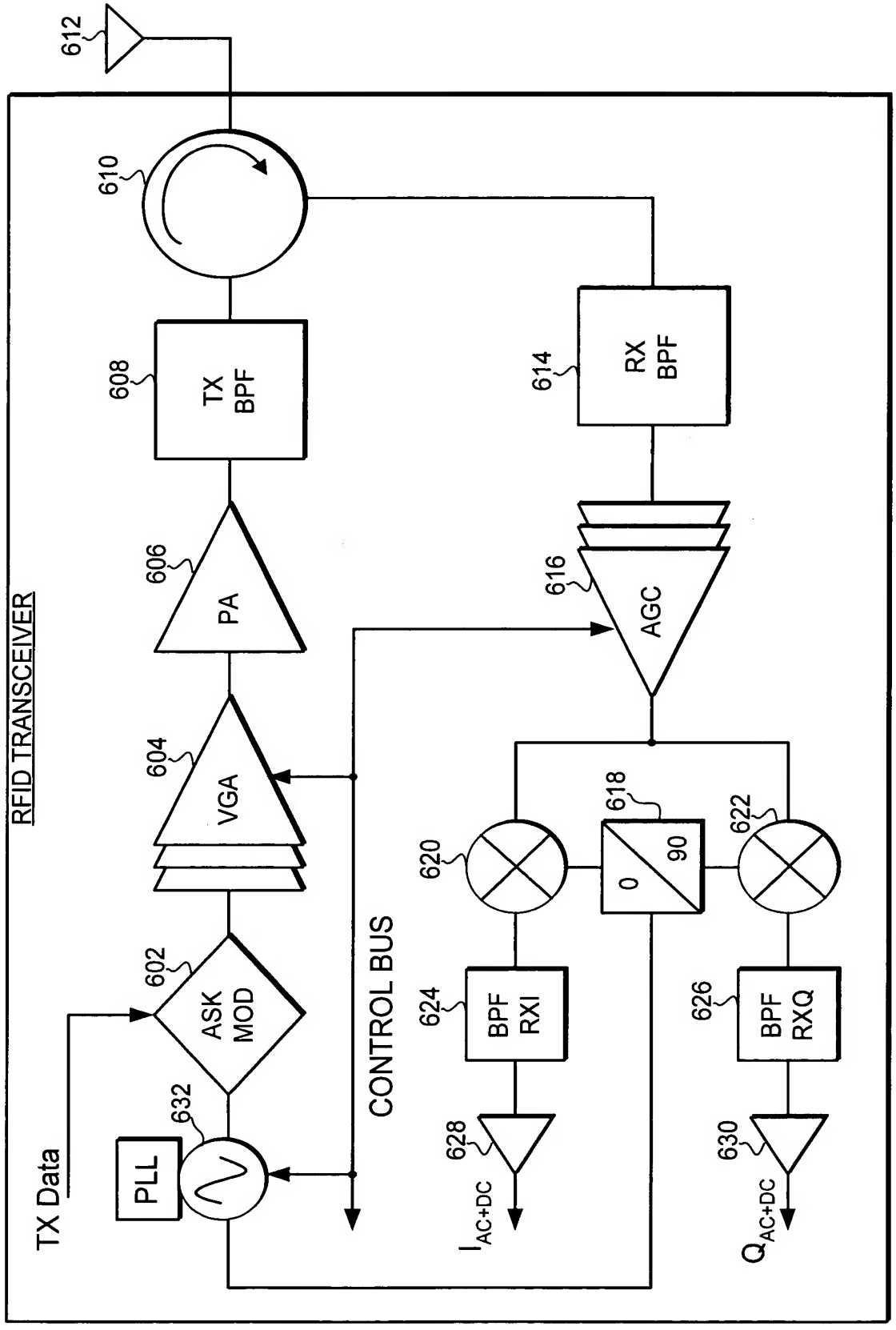

612
610
608
TX BPF
614
RX BPF
606
PA
616
AGC
604
VGA
618
620
622
0
90
602
ASK MOD
624
BPF RXI
626
BPF RXQ
632
PLL
628
630
TX Data
CONTROL BUS
I_{AC+DC}
Q_{AC+DC}
RFID TRANSCEIVER
600

FIG. 6

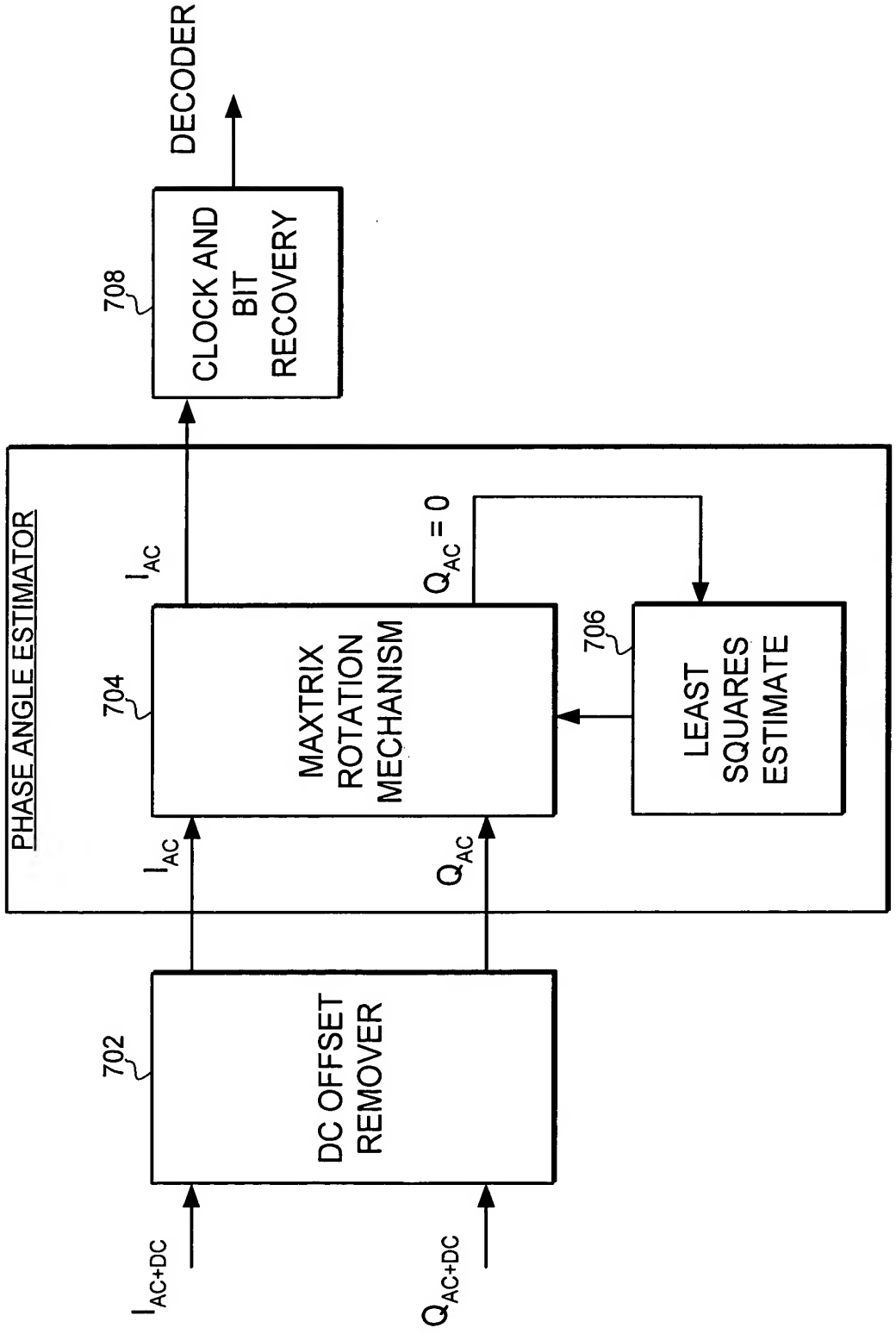

DECODER
708
CLOCK AND BIT RECOVERY
PHASE ANGLE ESTIMATOR
I_{AC}
$Q_{AC} = 0$
704
MAXTRIX ROTATION MECHANISM
706
LEAST SQUARES ESTIMATE
I_{AC}
Q_{AC}
702
DC OFFSET REMOVER
I_{AC+DC}
Q_{AC+DC}
700

FIG. 7

FUND FREQ (MHz)	RELATIVE PHASE MEASUREMENT (RADIANS)
912	4.135648662
922	2.958062428
910	0.654528847
904	1.294354711
926	0.33711675
918	5.779008106
908	5.25659434
906	4.975474525
924	5.839182243
902	0.113234896
914	4.216768477
920	6.26012792
928	2.018236565
916	4.497888291

800

FIG. 8

FUND FREQ (MHz)	RELATIVE PHASE UNWRAPPED (RADIANS)
902	0.113234896
904	1.294354711
906	4.975474525
908	5.25659434
910	6.937714155
912	10.41883397
914	10.49995378
916	10.7810736
918	12.06219341
920	12.54331323
922	15.52443304
924	18.40555286
926	19.18667267
928	20.86779249

900

FIG. 9

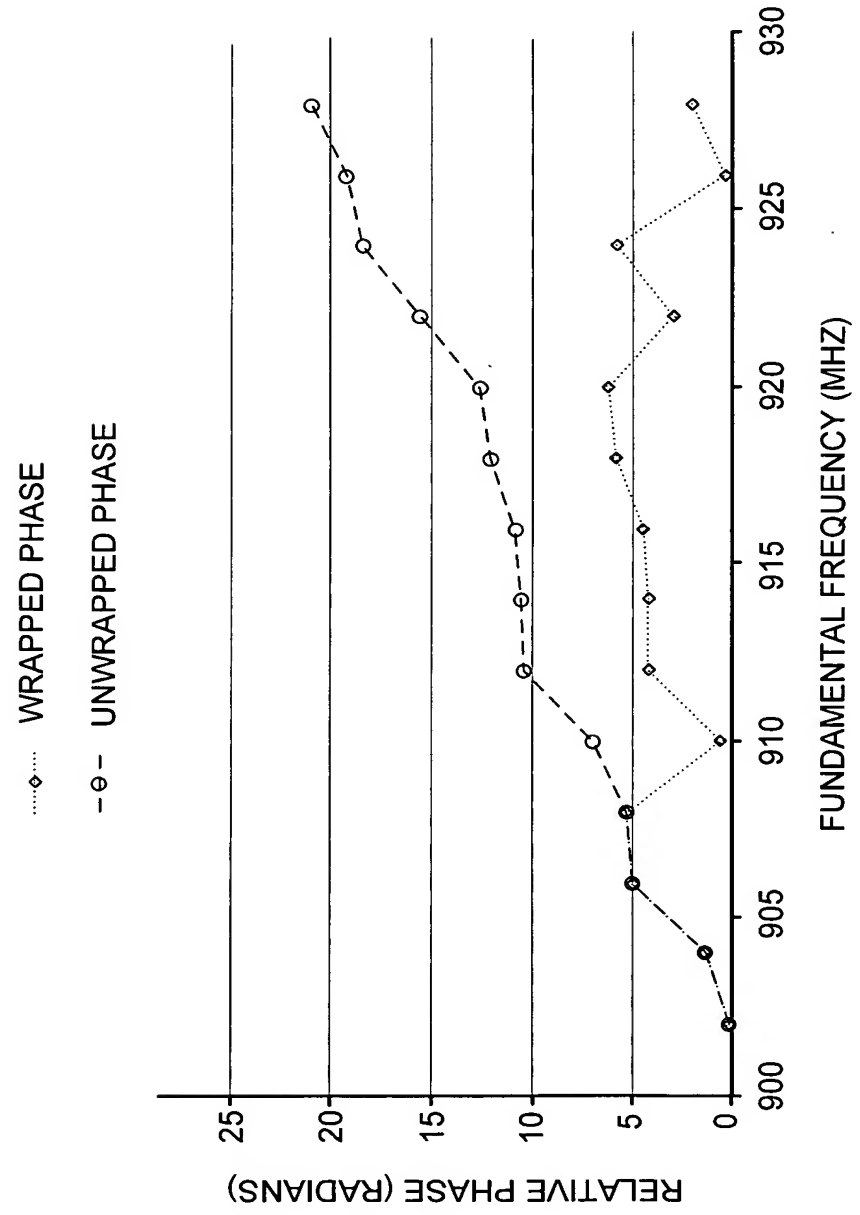

WRAPPED PHASE
UNWRAPPED PHASE
RELATIVE PHASE (RADIANS)
25
20
15
10
5
0
900
905
910
915
920
925
930
FUNDAMENTAL FREQUENCY (MHZ)
1000

FIG. 10

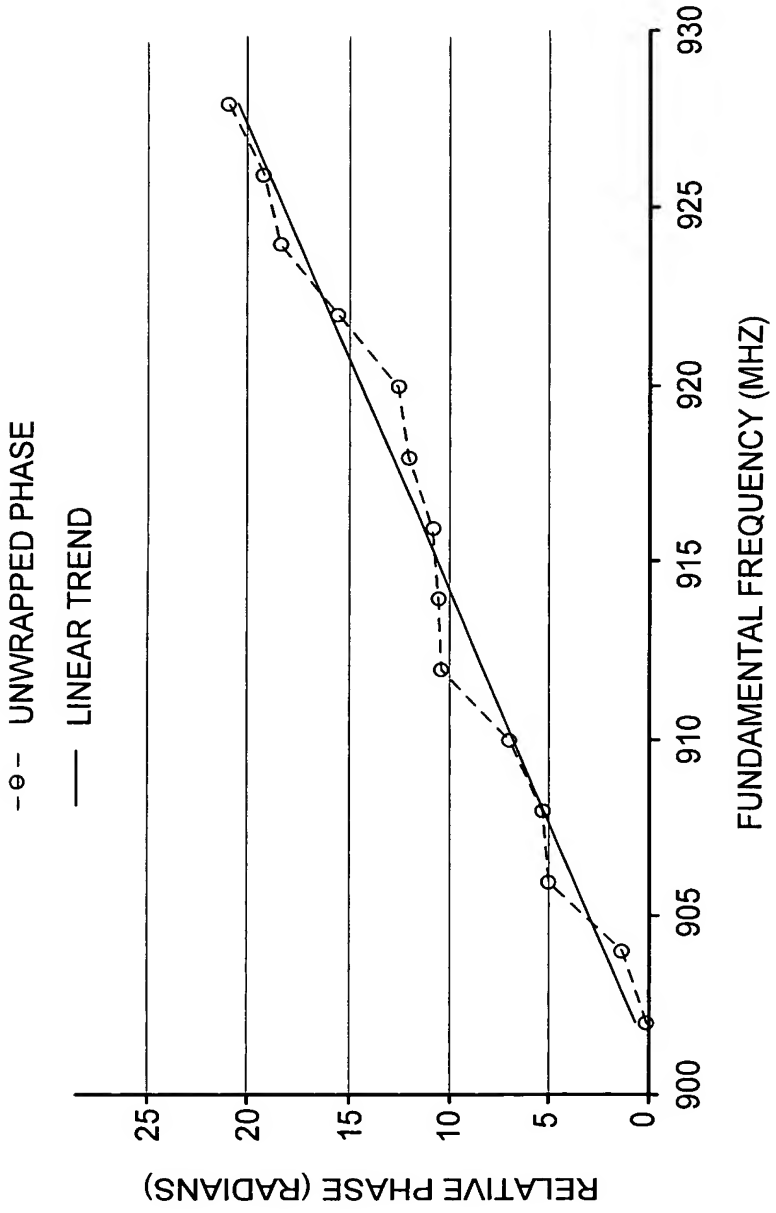

-θ- UNWRAPPED PHASE
LINEAR TREND
RELATIVE PHASE (RADIANS)
25
20
15
10
5
0
900
905
910
915
920
925
930
FUNDAMENTAL FREQUENCY (MHZ)
1100

FIG. 11